



Food and Agriculture  
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Indian Ocean Tuna Commission  
Commission des Thons de l'Océan Indien

# Sample selection strategies

*IOTC ROS SFO TR11*

Category: Sampling methods and strategies

*IOTC ROS SFO TR11*



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## Biometric Sampling

**Biometric sampling entails collecting selected biological information from the catch**

**Observer need to be acquainted with**

- tools, units, codes and formats used by IOTC ROS when collecting biometrics
- determining sex of different species and the maturity scales *if required*
- collect, preserve, and record samples details (*including DNA samples*)
- photographing species for identification
- collecting information on tagged specimens



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Biometric sampling entails collecting a range of biological information from selected species of the catch. Normally this is focused on the main target species that are being managed by the IOTC, however, it can also include species of special interest that are also being studied. To achieve these requirements observers must be familiar with:

- the tools, units, codes and formats used by IOTC ROS in the collection of biometrics;
- acquainted with IOTC ROS standards to determine sex of different species and the maturity scales (if any);
- collection, preserve, store and correctly label samples (including DNA samples);
- photographing species for identification; and
- collecting information on tagged specimens.



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## Biometric Sampling

**Biometric sampling entails collecting selected biological information from the catch and includes collecting data on**

- length only for size composition
- combination of Length & Weight
- age and growth
- sex and maturity
- diet
- DNA sampling for determining specific species

**Various methods or combination of method used to collect this data**



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Overall biometric sampling (biological sampling) includes collecting data on:

- length for size composition of the catch;
- selected sampling for Length and Weight of individual fish to draw up length/weight regressions;
- otolith or spine sampling to determine age and growth
- sex and maturity of specific species to determine the time and areas that fish spawn;
- determining the diet of the fish by examining stomach contents; and
- collecting DNA samples, often to determine differences between stocks of the same species that may need to be individually managed, for example swordfish found in the Indian Ocean region and the Atlantic Ocean;

Various methods or a combination of method can be used to collect biometric data. Length frequency of the catch will require larger and statistical means to capture the size profile of the entire catch. While measuring length and weigh and collecting other biological data may require fewer and selected samples. *For example; selecting fish of different sizes to weigh and measure to draw up a length-weight regression.*



## Biometric Sampling

### RECORDING LENGTHS

Lengths one of the most important biometric units recorded by observers provides information on *inter alia*

- length at age
- length at maturity
- Length / weigh regressions *assist in determining unprocessed weigh when access limited only to processed product*

### Length measurement Tools

- **Callipers** – accurate but limited in size and bulky
- **measuring board** robust and accurate but limited in size and fish anatomy
- **flexible tape** robust practical and cover a wide range of length but limited accuracy
- **electronic measuring boards** – limited for specialised sampling not robust



### Recording lengths

Recording length is one of the most important biometric units recorded by observers. It provides information on a range of factors used by scientists when analysing the biology of the species that includes *inter alia*

- length at age i.e. how fast fish grow and how old are the fish being caught
- length at maturity i.e. At what length and age do fish mature, and are the fish being caught still juveniles that have not yet spawned. It is important for a fishery to survive that the spawner biomass is preserved.
- Length / weigh regressions assist in determining the original unprocessed weigh of fish when there is access only to the processed product (green weight or nominal weight), which is important when determining the actual total amount of fish that is being removed from the biomass of the stock.

### Length measurement Tools

Range of tools can be used to record fish lengths. The most common being:

**Callipers** – Good for measuring small and medium size tuna and by-catch species. Their main advantage is their accuracy, and they can accurately record straight measurements on tuna that have a solid round trunk that cannot be flattened out. However, their maximum measurement is limited to approximately 1.5m.

**Measuring Board** robust and accurate, ideal for taking flat measurements and can be used to rapid measure smaller fish, less than 1.2 meters and recording only a single parameter.

**Flexible Tape** robust and practical and is a versatile means of measuring large tuna and billfish. It

is easily carried around in your pocket. However, it must be used correctly to record straight measurements. If the curve of the fish is recorded this must be clearly noted.

**Electronic Measuring Boards** –use mechanical electronic touch sensors to record measurements on a digital display and directly onto electronic data systems. Limited to specialised sampling and they are not robust.



## Biometric Sampling

### MEASUREMENTS TO BE TAKEN

**Observers must be clear on exactly what length measurements they are recording. The following points must be noted**

All measurements must be **rounded down** to the **lower** whole cm

*e.g. Length of 43.1 cm or 43.8 cm is rounded down and recorded as 43 cm*

All measurements must be associated with a **measurement type** and **measurement tool**

- FT - Curved fork length taken with a tape measure
- FB - Board fork length taken with a board
- FL - Fork length taken with a calliper

*T=tape [curved] / B=board / L=calliper [or straight measurement]*



### MEASUREMENTS TO BE TAKEN

Observers must be clear on exactly what measurements they are recording, and the following points must be always noted:

- all measurements must be made in the lower cm;

*If the length of the fish is 43.1 cm or 43.8 cm it will be recorded as 43 cm. i.e. zero decimal places*

- all measurements must be associated with a measurement type and a measurement tool, and these recorded using IOTC ROS approved codes;
  - FT - Curved fork length taken with a tape measure;
  - FB - Board fork length taken with a board;
  - FL - Fork length taken with a calliper, etc.
- always try to measure a fish on a flat surface; and
- never measure a crushed, broken, or deformed fish. (Better to reject the fish and select another specimen)



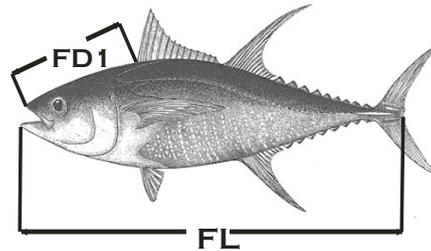
## Biometric Sampling

### MEASUREMENTS TO BE TAKEN

Standard length measurements taken for different species group are referred to as **REFERENCE LENGTHS**

The primary reference measurements for tuna are “fork length” (FL)

measured as a straight-line from the tip of the snout to the fork of the tail



The primary reference measurements for tuna are “fork length” (FL), measured as a straight-line from the tip of the snout to the fork of the tail. If these measurements are taken in a curved-line using a measuring tape, they are to be referred to as “curved fork length” (FT).

In situations where the fish are too large for the available equipment or the tails have been cut off for production purposes then the alternative measurements that can be taken is “first dorsal length” (FD1), Also called pre-dorsal length, measured as a straight-line from the tip of the upper jaw to the insertion of the first dorsal spine (or the “curved first dorsal length (FD1T) if taking a curved-measurement).



## Biometric Sampling

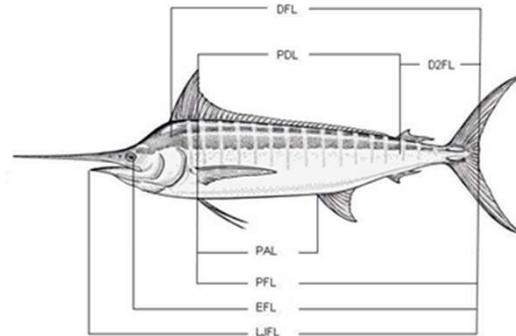
### Standard length measurements taken for Billfish

The primary reference length measurement for billfish is “lower jaw fork length” (FL)

measured as a straight-line from the tip of the lower jaw to the fork of the tail

Alternative measurements are

- Eye-fork length (EF)
- Pectoral-fork length (PF)
- Pectoral-dorsal length (PDL)
- Pectoral-anal length (PAL)



### Billfish length measurements

Due to the elongated bill that can easily be broken and which is often cut off soon after landing to prevent crew injury, and the main reference measurements for Billfish is “lower jaw fork length” (LJFL) measured from the tip of the lower jaw to the fork of the tail.

The length of most billfish makes it impractical to use callipers or a measuring board and the preferred measurements are taken with a flexible tape pulled over the contours of the body. In such cases these measurements, taken in a curved-line, are to be referred to as “curved lower jaw fork length” (LJFT).

On some commercial vessels it may not be possible to take the LJFL length as the fish are first dressed by the crew and a number of alternative measurements can be taken in these situations:

**Eye-fork length (EF)** Measurement is taken on a straight-line from the posterior edge of the eye socket to the fork of the tail (or the “curved eye-fork length” (ET) if taking a curved-measurement);

**Pectoral-fork length (PF)** The length is taken on a straight-line from the most anterior insertion of the pectoral fin to the fork of the tail (or the “curved pectoral-fork length” (PT) if taking a curved-measurement).

**Pectoral-dorsal length (PDL)** The length is taken on a straight-line from the most anterior insertion of the pectoral fin to the most anterior insertion of the second dorsal fin (or the “curved pectoral-dorsal length” (PDT) if taking a curved-measurement).

**Pectoral-anal length (PAL)** The length is taken on a straight-line from the anterior insertion of the pectoral fin to the posterior rim of the anal sphincter (or the “curved pectoral-ANAL length” (PDT) if

taking a curved-measurement).



Example of a swordfish straight measurement lower jaw fork length" (LJFL) measured from the tip of the lower jaw to the fork of the tail.



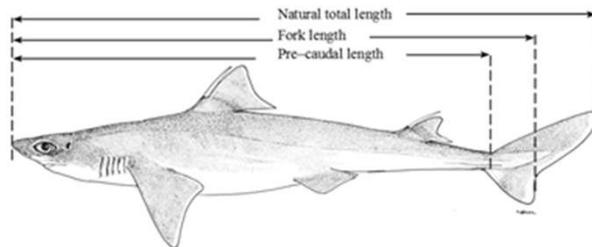
# Biometric Sampling

## Standard length measurements taken for Sharks

Sharks are mainly measured for total length (TL), from the tip of snout to extreme end of tail in a straight line

Alternative measurements are

- Fork Length (FL)
- Pre-caudal Length (PCL)



## Shark Length Measurements

Sharks are preferably measured for total length (TL), from the tip of snout to extreme end of tail in a straight line, also called natural total length.

Alternative measurements are:

- Fork Length (FL)                      The length is taken on a straight line from the tip of the snout to the fork in the tail (or the “curved fork length” (FT) if taking a curved-measurement); and
- Pre-caudal Length (PCL)            The length is taken on a straight line from the tip of the snout to the pre-caudal notch (or the “curved pre-caudal length” (PCT) if taking a curved-measurement).



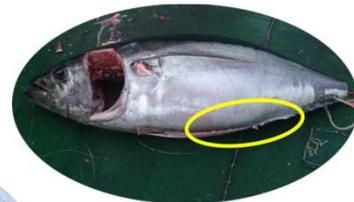
## Biometric Sampling

### SEX AND MATURITY TUNA

#### Provides information on length at maturity

*Collected mainly on longlines where fish are processed or for specific biological sampling requirements*

The male and female gonads tuna and billfish found in the ventral part of the body cavity close to the cloaca.



An important part of managing a resource is a good understanding of their biology. When specified in the sampling program the sex or gender of the fish may also be required as this provides information on length at maturity and can result in mitigation measures to limit catches of juvenile fish.

On purse-seiners the tuna caught are often juveniles, especially those caught around FAD's and the fish are frozen whole and it is unlikely that sexing of the tuna will be required.

However, on tuna longliners where adult fish are mostly caught, information on length, sex and maturity can be determined by first taking the length measurements and then checking the gonads for sex and maturity when the crew clean the fish.

The male and female gonads for both tuna and billfish are found in the ventral part of the body cavity close to the cloaca.



## Biometric Sampling

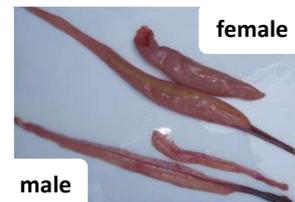
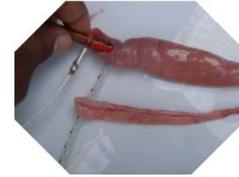
### SEX AND MATURITY TUNA

#### Female gonads

- soft and round texture
- oocytes (eggs) visible
- round in cross section
- an opening in the center

#### Male gonads

- flatter or triangular
- smooth “rubbery” texture
- milt visible [*if they are cut*]
- does not have an opening no matter how big



### Tuna

Female gonads are soft to the touch and have a “granular” texture inside. Oocytes may be visible in more mature females. The gonads are round in cross section and there is a easily discernible hole or tube in the centre of the gonad.

Male gonads are flatter or triangular in shape and have a smooth sometimes rubbery feel. In more mature males milt may be seen if they are cut. There is no hole or opening in the cross section of male gonads, no matter how big the fish is.



## Biometric Sampling

### SEX AND MATURITY BILLFISH

**Challenges with determining sex in swordfish and other billfish are that gonads are very similar**



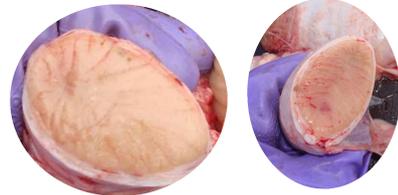
#### Female gonads

- round in cross section
- an opening or lumen in the center of gonad



#### Male gonads

- Slightly oval in cross section
- Has an opening or lumen off-set to one side



### Swordfish and other Billfish

The difference between male and female billfish gonads are more difficult to see as both are externally very similar, rounded in cross section and have relatively similar consistency.

The key to telling the difference is to identify the position of the lumen which is a tube that runs through the length of the gonad:

- in a female these are found in the centre of a cross section; and
- in a male the lumen is offset to one side.



## Biometric Sampling

### MATURITY STAGE

**A maturity stage scale is based on macroscopic criteria on the development of the oocytes on the gonads**

Visually it is generally determined on a number of criteria that includes

- gonad size
- Colour
- Consistency
- Vascularization
- Visible presence or absence of oocytes in females
- Visible presence of milt in a cut of male gonads



A maturity stage scale is based on macroscopic criteria of the oocytes on the ovaries and sperm in the male gonads.

Visually it is generally determined on a number of criteria that includes:

- Size relative to the abdominal cavity;
- colour;
- consistency;
- vascularization;
- visible presence or absence of oocytes in females ovaries; and
- visible presence of milt in a cut of male gonads.

The maturity is then reported on a *generally accepted* 5 scale index from 1-immature to 5-spent.



# Biometric Sampling

## MATURITY STAGE

Stage	Female	Male
1	Ovaries and gonads small ribbon like and difficult to determine sex	
2	Ovaries easy to see but cannot see oocytes	Gonads enlarged triangular, smooth and rubbery. No milt visible
3	Gonads enlarged, oocytes easily visible, generally dark red or orange	Gonads enlarged and milt visible if cut
4	Ovaries enlarged, oocytes hydrated, run freely if squeezed or cut	Gonads enlarged and milt runs freely if squeezed or cut
5	Ovaries reduced in size, firm with no oocytes, dark red to purple in colour	Gonads reduced in size and firmer to touch and dark red to purple in colour



No standard maturity scales have been approved to date by the Indian Ocean Tuna Commission (IOTC). The slide provides a generic maturity scale for five stages, however the conditions for different species can vary and observers are likely to be provided with specific notes when requested to collect maturity data.



## Biometric Sampling

### SEX AND MATURITY SHARKS

#### Shark Gender Determination

The sex of sharks and rays determined externally by the presence or absence of claspers anterior to the anal fin

- Claspers are prominent in mature males
- Completely absent in females.



The sex of sharks and rays can easily be determined externally by the **presence** or **absence** of a pair of claspers on the anal fins. Claspers are very prominent in mature males, more subtle in juvenile males and completely absent in females.



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# ANY QUESTIONS?



*send us a message via Talents LMS*



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